CLAIMS

1. A composite conductor for use as a winding of a high voltage electrical machine, comprising:

a plurality of strands of conductor material forming a conductor bundle which in cross-section is of generally rectangular shape, the strands being insulated from each other within the bundle,

an insulating sleeve of substantially homogeneous polymeric material surrounding the conductor bundle; the insulating sleeve also having a generally rectangular shape in cross-section and the polymeric material being filled with at least one electrically insulating filler material which conducts heat more efficiently than the polymer alone, and

conductive material forming a corona shield coating at the inner and outer surfaces of the insulating sleeve.

2. A composite conductor according to claim 1, the corners of the conductor bundle's rectangular shape being radiused to minimise electrical stress concentrations.

3. A composite conductor according to claim 2, the radius dimensions of the corners of the conductor bundle being up to about 5 mm.

4. A composite conductor according to claim 3, the radius dimensions being between 2-3 mm.

5. A composite conductor according to any preceding claim, the corners of the insulating sleeve being substantially rectilinear.

6. A composite conductor according to claim 5, the corners of the insulating sleeve having a radius of not more than about 1mm.

7. A composite conductor according to any preceding claim, the strands in the bundle of conductor material being collectively twisted around the longitudinal centreline of the conductor bundle, thereby to reduce winding losses from eddy currents.

8. A composite conductor according to any preceding claim, that at least one insulating filler material in the polymer insulating sleeve being a metallic oxide and/or a metallic nitride.

9. A composite conductor according to any preceding claim, the polymeric sleeve material comprising a high-temperature resistant polymer.

10. A composite conductor according to claim 9, the polymeric sleeve material comprising a fluoropolymer or an aromatic polymer.

11. A composite conductor according to any preceding claim, the conductive coating material comprising a graphitic or silicon based material.

11. A composite conductor according to claim 11, the conductive coating material comprising a high-temperature resistant polymer or paint material which has sufficient of the conductive material incorporated therein to render it conductive.

12. A composite conductor according to claim 11 or claim 12, the conductive coating material being an extruded film.

13. A composite conductor according to any preceding claim, the conductor strands being insulated from each other by means of a high-temperature resistant insulating coating applied to each strand during manufacture of the strands before their incorporation into the conductor bundle.

Replaced by Article 19

14. A composite conductor according to any one of claims 1 to 13, the conductor strands being insulated from each other by means of impregnation of the conductor bundle with a curable high-temperature resistant insulating material during incorporation of the strands into the conductor bundle.

15. A process for making a composite conductor, comprising the steps of:

gathering together a plurality of strands of conductor material into a conductor bundle and twisting the bundled strands bodily about a longitudinal centreline of the bundle to form a twisted conductor bundle,

impregnating the conductor bundle with a curable high-temperature resistant insulating material, the impregnation occurring one of simultaneously with the gathering and twisting process and subsequent thereto,

applying a coating of conductive material to the exterior of the twisted conductor bundle to form a first, inner, corona shield,

extruding an insulating sleeve of homogeneous polymeric material onto the coating of conductive material on the conductor bundle, the polymeric material having been previously filled with at least one insulating filler material which conducts heat more efficiently than the polymer alone, and

applying a coating of conductive material to the outer surface of the insulating sleeve to form a second, outer, corona shield;

wherein each strand of conductor material is provided with an insulating coating by at least one of coating the strands before the formation of the conductor bundle, and coating the strands during the impregnation step.

16. A process according to claim 16, in which after twisting of the bundle, the bundle is formed to a predetermined cross-sectional shape.

17. A process according to claim 17, in which the predetermined cross-sectional shape is rectangular.

18. A process according to any one of claims 16 to 18, in which the impregnated conductor bundle is partially cured before the coating of conductive material is applied to the outside of the conductor bundle.

19. A stator for a rotary electrical machine, comprising a laminated steel core provided with a plurality of radially oriented slots extending longitudinally of the stator, each slot housing a winding comprising a plurality of turns of a single length of a composite conductor constituted according to claim 1, successive turns of the composite conductor being in contact and in radial registration with each other.

20. A stator for a rotary electrical machine, comprising a laminated steel core provided with a plurality of radially oriented slots extending longitudinally of the stator, each slot housing a winding comprising a plurality of turns comprising a plurality of lengths of a composite conductor constituted according to claim 1, successive turns of the composite conductor being in contact and in radial registration with each other.

21. A stator according to claim 20 or claim 21, the winding being retained in its slot by a high thermal conductivity, electrically insulating retaining means fixed in the radially outer end of the slot.

22. A method of making a stator constituted according to claim 21 or claim 22, in which the conductor bundle has been impregnated with a curable high-temperature insulation material and is wound onto the stator core while the curable high-temperature insulation material is only partly cured, attaching support means to the composite conductor where it is unsupported by the stator slots, and heat treating the completed stator to cure the curable high-temperature insulation material and produce a rigid stator winding.

23. A composite conductor substantially as described herein, with reference to Figures 2 to 4 of the accompanying drawings.

24. A method of manufacturing a composite conductor substantially as described herein, with reference to Figures 2 to 5 of the accompanying drawings.

25. A stator for a rotary electrical machine substantially as described herein, with reference to Figure 4 of the accompanying drawings.

26. A method of manufacturing a stator for a rotary electrical machine substantially as described herein, with reference to Figure 4 of the accompanying drawings.

AMENDED CLAIMS

[received by the International Bureau on 6 September 2000 (06.09.00); original claims 24-26 cancelled; original claim 8 amended; claims 11-22 renumbered as claims 12-23 other claims unchanged (3 pages)]

7. A composite conductor according to any preceding claim, the strands in the bundle of conductor material being collectively twisted around the longitudinal centreline of the conductor bundle, thereby to reduce winding losses from eddy currents.

8. A composite conductor according to any preceding claim, the at least one insulating filler material in the polymer insulating sleeve being a metallic oxide and/or a metallic nitride.

9. A composite conductor according to any preceding claim, the polymeric sleeve material comprising a high-temperature resistant polymer.

10. A composite conductor according to claim 9, the polymeric sleeve material comprising a fluoropolymer or an aromatic polymer.

11. A composite conductor according to any preceding claim, the conductive coating material comprising a graphitic or silicon based material.

12. A composite conductor according to claim 11, the conductive coating material comprising a high-temperature resistant polymer or paint material which has sufficient of the conductive material incorporated therein to render it conductive.

13. A composite conductor according to claim 11 or claim 12, the conductive coating material being an extruded film.

14. A composite conductor according to any preceding claim, the conductor strands being insulated from each other by means of a high-temperature resistant insulating coating applied to each strand during manufacture of the strands before their incorporation into the conductor bundle.

15. A composite conductor according to any one of claims 1 to 13, the conductor strands being insulated from each other by means of impregnation of the conductor bundle with a curable high-temperature resistant insulating material during incorporation of the strands into the conductor bundle.

16. A process for making a composite conductor, comprising the steps of:

gathering together a plurality of strands of conductor material into a conductor bundle and twisting the bundled strands bodily about a longitudinal centreline of the bundle to form a twisted conductor bundle,

impregnating the conductor bundle with a curable high-temperature resistant insulating material, the impregnation occurring one of simultaneously with the gathering and twisting process and subsequent thereto,

applying a coating of conductive material to the exterior of the twisted conductor bundle to form a first, inner, corona shield,

extruding an insulating sleeve of homogeneous polymeric material onto the coating of conductive material on the conductor bundle, the polymeric material having been previously filled with at least one insulating filler material which conducts heat more efficiently than the polymer alone, and

applying a coating of conductive material to the outer surface of the insulating sleeve to form a second, outer, corona shield;

wherein each strand of conductor material is provided with an insulating coating by at least one of coating the strands before the formation of the conductor bundle, and coating the strands during the impregnation step.

17. A process according to claim 16, in which after twisting of the bundle, the bundle is formed to a predetermined cross-sectional shape.

18. A process according to claim 17, in which the predetermined cross-sectional shape is rectangular.

19. A process according to any one of claims 16 to 18, in which the impregnated conductor bundle is partially cured before the coating of conductive material is applied to the outside of the conductor bundle.

20. A stator for a rotary electrical machine, comprising a laminated steel core provided with a plurality of radially oriented slots extending longitudinally of the stator, each slot housing a winding comprising a plurality of turns of a single length of a composite conductor constituted according to claim 1, successive turns of the composite conductor being in contact and in radial registration with each other.

21. A stator for a rotary electrical machine, comprising a laminated steel core provided with a plurality of radially oriented slots extending longitudinally of the stator, each slot housing a winding comprising a plurality of turns comprising a plurality of lengths of a composite conductor constituted according to claim 1, successive turns of the composite conductor being in contact and in radial registration with each other.

22. A stator according to claim 20 or claim 21, the winding being retained in its slot by a high thermal conductivity, electrically insulating retaining means fixed in the radially outer end of the slot.

23. A method of making a stator constituted according to claim 21 or claim 22, in which the conductor bundle has been impregnated with a curable high-temperature insulation material and is wound onto the stator core while the curable high-temperature insulation material is only partly cured, attaching support means to the composite conductor where it is unsupported by the stator slots, and heat treating the completed stator to cure the curable high-temperature insulation material and produce a rigid stator winding.

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